

DIGEST OF TRENDS
IN U.S. ENERGY MARKETS



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Digest of Trends in U.S. Energy

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DIGEST OF TRENDS IN U.S. ENERGY MARKETS

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I ENERGY INDUSTRY PROFILE



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I ENERGY INDUSTRY PROFILE

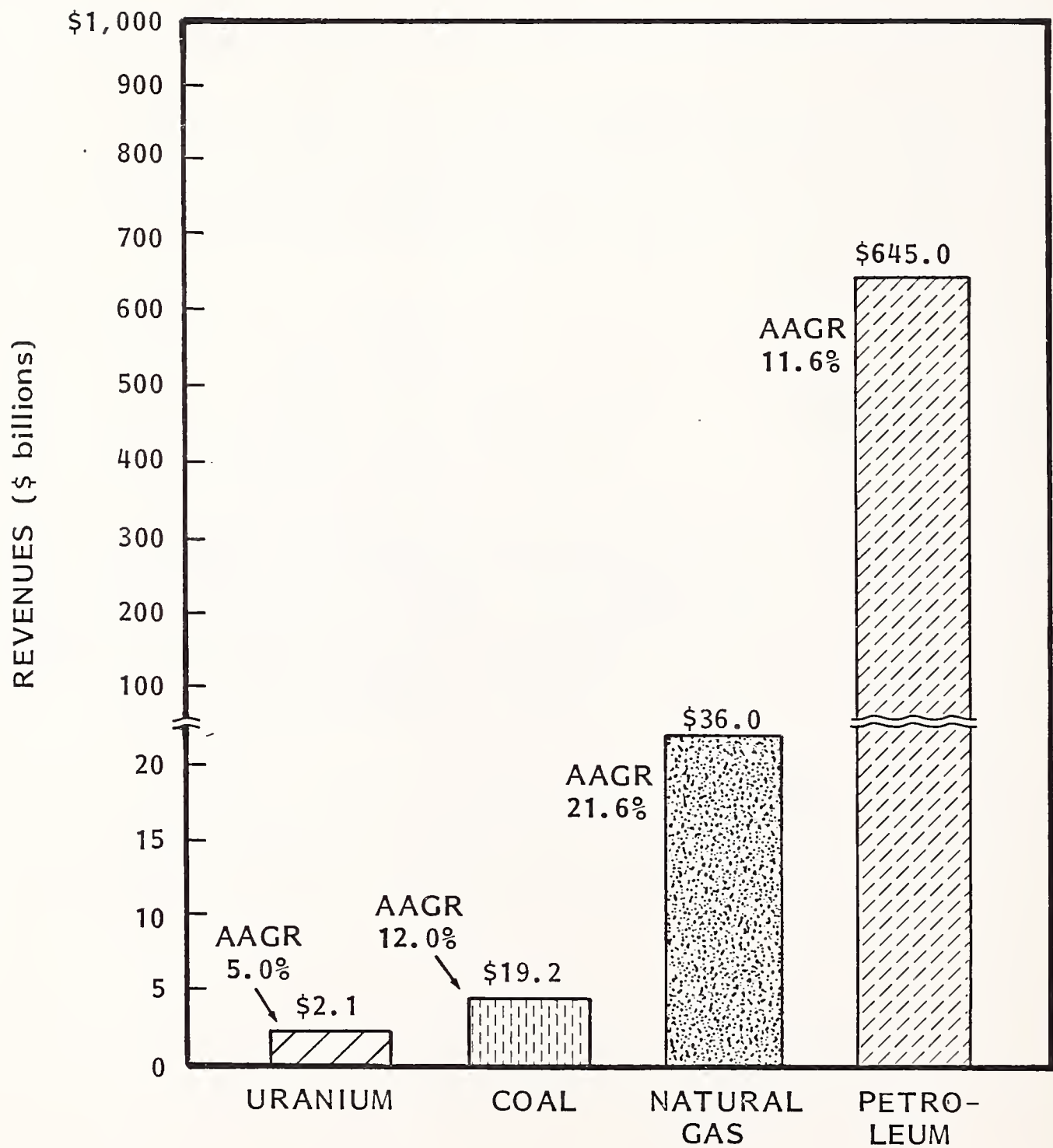
- Opportunities for computer services in energy industry markets are very significant, with expenditures by energy companies reaching \$1 billion in 1980. The market is forecast to reach \$5 billion by 1985 if the price for crude oil does not fall.

A. REVENUES

- Revenues in 1980 for some 1,500 companies involved in energy industry markets exceeded \$700 billion. Petroleum companies dominate the marketplace, as illustrated in Exhibit I-1. With 1980 revenues of nearly \$650 billion, petroleum companies comprise over 90% of the market.
- In 1980, revenues of eight major integrated petroleum companies exceeded \$350 billion. Another 12 semi-major companies, either fully integrated or nearly so, together with the majors comprised 75% of total petroleum industry revenues.
- Some 50 large and medium-sized coal companies, or 13% of total companies with 1980 aggregate revenues exceeding \$12 billion, comprised 65% of total coal industry revenues.

EXHIBIT I-1

STRUCTURE OF ENERGY MARKETS BY INDUSTRY SECTOR, 1980



TOTAL REVENUES \$702.3 billion
TOTAL COMPANIES 1,586
AAGR 12%

- There are 84 companies involved in the production and transmission component of natural gas, 32 of which make up 85% of industry revenues.
- In the uranium industry, 15 companies, or 7% of those which are involved in the exploration, production, and processing (to enrichment) subsectors, control 61% of all reserves and 98% of current milling capacity.
- Petroleum companies are becoming integrated energy companies by obtaining control of major portions of other energy markets. In 1977, the 20 largest petroleum companies controlled: 74% of natural gas production and transmission, 27% of coal production and nearly 50% of total uranium reserves and production.

B. EDP EXPENDITURES

- Expenditures outlined in this section are for EDP (as opposed to process control) functions and only in the related subsectors for each of the four industry sectors comprising energy markets.
- Energy companies spend between 0.75% and 2.0% of total company revenues for EDP. As shown in Exhibit I-2, total 1980 EDP expenditures were nearly \$5.5 billion. The major portion (82%) of total EDP expenditures was for in-house operations.
- Petroleum companies, spending 0.75% of total revenues, account for nearly 90% of total EDP expenditures in energy markets. In contrast, coal and natural gas companies spend about 1.9% of total revenues, and uranium companies spend 2%.
- Having gone through a seven year EDP centralization cycle, large petroleum companies are finding that the information pipeline is becoming clogged. Major efforts are underway, particularly in exploration, to distribute computer

EXHIBIT I-2

DISTRIBUTION OF EDP EXPENDITURES IN ENERGY MARKETS
BY INDUSTRY SECTOR, 1980

INDUSTRY	EDP EXPENDITURES (\$ millions)		
	IN-HOUSE	COMPUTER SERVICES	TOTAL
Petroleum	\$4,005	\$875	\$4,880
Natural Gas	315	45	360
Coal	155	35	190
Uranium	30	10	40
Total	\$4,505	\$965	\$5,470

power to district offices, and allow production groups to have separate computers for engineering applications.

- Mega-minicomputers are being used for selected seismic processing, synthetic analysis, stratification modeling, and computer-aided interpretation.
- Minicomputer driven computer-aided design (CAD) systems are being applied to exploration and production mapping applications, using distributed data bases transferred from host systems.
- Recognizing the importance of information as a resource, major coal companies are upgrading EDP systems, installing comprehensive communications networks with intelligent terminals in all mines and engineering and division offices for mine planning and materials management.
- Having applied advanced computer technology to process and production control operations, petroleum companies that have acquired coal producers are accelerating coal company automation through technology transfer.

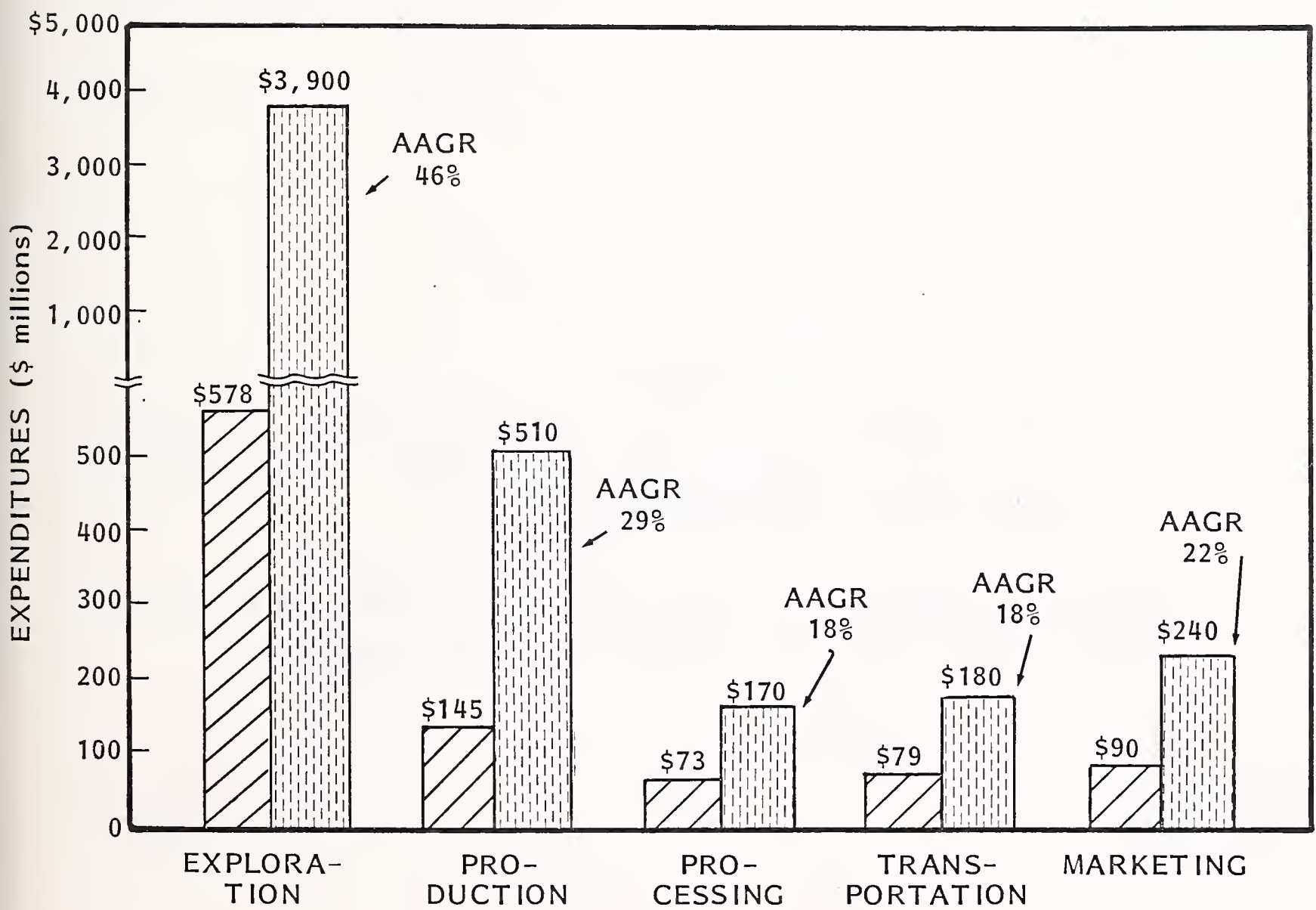
C. COMPUTER SERVICE EXPENDITURES

- Energy companies use external computer services in order to: obtain technical specialization, on an overflow basis to meet heavy demand, on an interim basis while upgrading systems, for faster turnaround than is available in-house, and to obtain computational resources not available in-house.
- The increased use of seismic data processing vendors by petroleum and natural gas companies results from widespread industry personnel shortages and from the need to use proprietary vendor-developed, state-of-the-art software.

- Energy companies make widespread use of consulting services to develop and use petroleum reservoir simulation models, coal dragline simulation systems, oil shale production planning and scheduling systems, and nuclear processing transport codes.
- Petroleum and uranium companies having to develop simulators for large problems such as 3-D reservoir or uranium milling systems, design them using large-scale vector computer resources from RCS vendors and transfer the completed system to an in-house supercomputer.
- Petroleum companies spend 18% of total EDP expenditures for computer services.
- As shown in Exhibit I-3, this is mainly in the exploration subsector, (primarily geophysical data processing). The portion that petroleum companies spend in the production subsector is mainly for reservoir (black oil and enhanced recovery) simulation.
- In the marketing subsector, where current price, delivery, and financial decisions in world money markets are time sensitive, petroleum companies have built elaborate on-line, in-house management information systems (MIS). Only 4% of nearly \$2 to \$3 billion in EDP expenditures is spent for computer services including credit verification and card processing, econometric forecasting, financial and management planning, and funds management computer services.
- The exploration and production subsectors are also principal growth markets with computer services expenditures of over \$700 million, or 75% of the total market in 1980. Growth is primarily limited by shortage of qualified personnel.

EXHIBIT I-3

FORECAST OF COMPUTER SERVICES EXPENDITURES BY ENERGY MARKET SUBSECTOR, 1980-1985



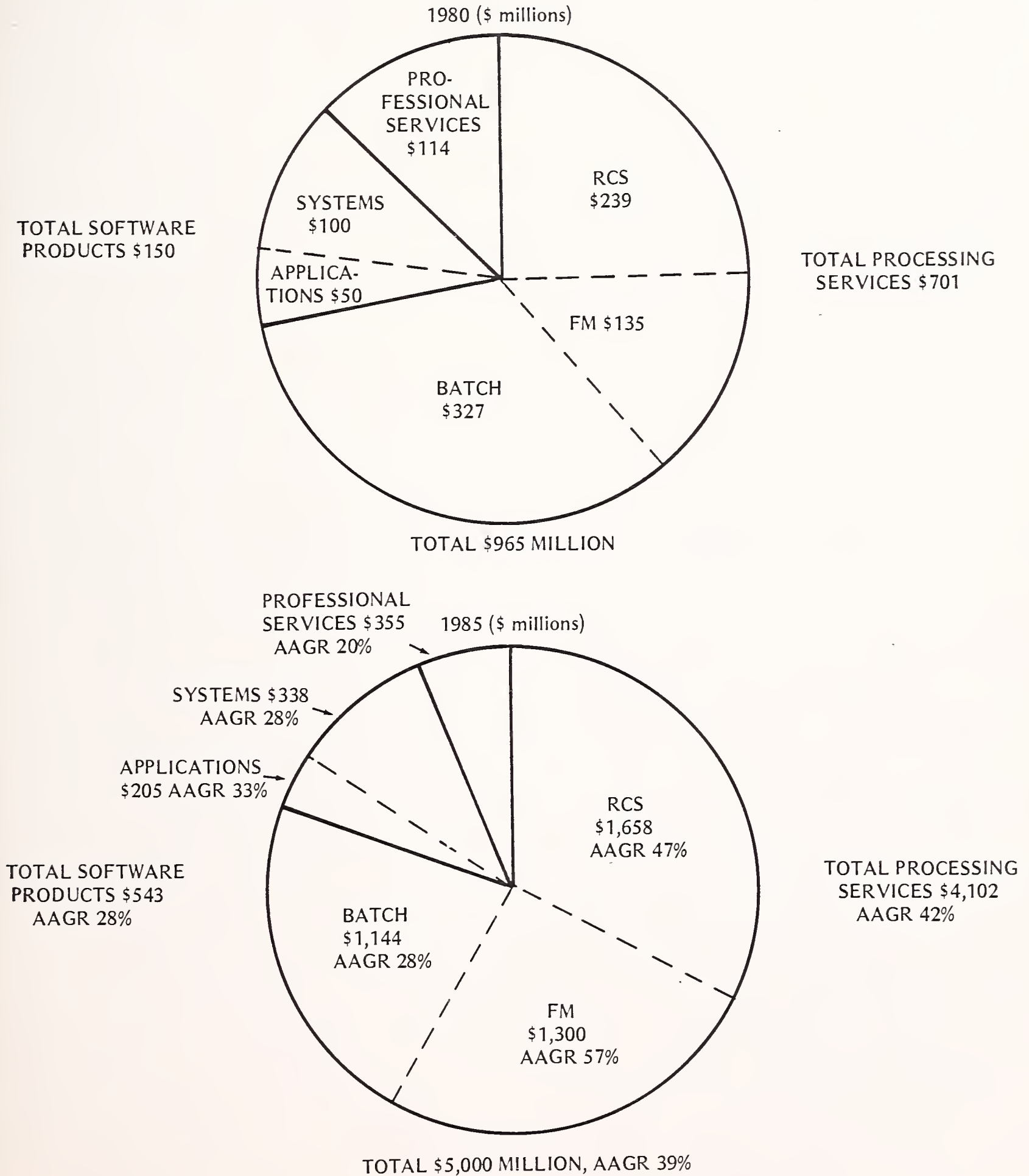
 1980 TOTAL \$965 million
 1985 TOTAL \$5,000 million

AAGR 39%

- Processing services accounted for nearly 73% of the total market in 1980, as shown in Exhibit I-4. Batch processing, currently the major delivery mode for processing, will give way to RCS as multitasking operating systems, with "user friendly" interface software, increase remote batch and interactive operation.
- Specialization is the key to success in offering processing services to energy companies. Over 90% of processing services to the petroleum industry are industry specific, as are 60% of processing services in other energy markets.
- Energy companies have unmet needs for products and services for:
 - User site systems for standalone and distributed processing of geo-physical, production, and engineering analysis.
 - Data base services.
 - Computer-aided mapping.
 - DBMS, including data dictionary and query software and services oriented toward engineering data, particularly for the exploration and production energy market subsectors.
- On-line data base services, estimated at \$25 million in 1980, will exceed \$250 million in 1985, an AAGR exceeding 50% over the next five years.

EXHIBIT 1-4

FORECAST OF COMPUTER SERVICES IN ENERGY
MARKETS BY MODE AND TYPE OF DELIVERY, 1980-1985



II MAJOR APPLICATIONS

II MAJOR APPLICATIONS

A. EXPLORATION

- Exploration for petroleum and natural gas is accomplished primarily by geophysical techniques, whereas for coal and uranium primarily by geological ones. The five major applications in petroleum and natural gas exploration are shown in Exhibit II-1.
- In 1980, seismic data acquisition crews recorded worldwide over one million line miles, 65% of which were in marine areas. Although line miles increased 17% over 1979, total data acquisition costs rose over 50% as the number of data recording channels per mile continued to rise from 46 to 92 on up to 1,024 for marine data, the sampling frequency more than doubled, and data in selected areas were taken in three versus two dimensions.
- Seismic data are acquired using increasingly more sophisticated minicomputers, on board either land vehicles or naval craft. Shortage of qualified seismic crew personnel is inducing geophysical contractors to accomplish preliminary data reduction on selected seismic data in or near the place of acquisition to insure its quality and accuracy. Major petroleum companies are experimenting with satellite transmission of seismic data from overseas locations.

EXHIBIT II-1

DISTRIBUTION OF EDP EXPENDITURES FOR PETROLEUM AND
NATURAL GAS EXPLORATION BY APPLICATION, 1980-1985

APPLICATION	PORTION (percent)		
	1980	1982	1985
Initial Seismic Processing	19%	18%	17%
Initial Seismic Interpretation	37	36	35
Seismic Reprocessing, Analysis, and Modeling	30	31	32
Well Log Analysis	4	3	2
Mapping	10	12	14
Total	100%	100%	100%

- The Society of Exploration Geophysicists reported that energy companies spent over \$2 billion in 1980 or 76% of geophysical exploration budgets, on the acquisition of seismic data, which was field recorded on magnetic tape and delivered to data processing centers for initial data reduction and processing. The volume of data is too great to handle in an economic manner by telecommunications yet.
- Seismic data reduction has been and to a large extent will continue to be a specialized and massive batch processing application. Remote batch is beginning to be used for processing parameter selection and for task rebundling. U.S. petroleum companies spent over \$210 million in 1980 for initial seismic processing, 42% more than in 1979; about half in-house and half with seismic processing vendors.
- The initial data may be processed several times before final interpretation. The processing is currently accomplished primarily in the batch mode, but remote batch and interactive techniques are becoming more widespread. U.S. petroleum companies spent over \$410 million in 1980 for initial seismic interpretation, 44% more in this more labor-intensive application than in 1979; again about half in-house and half with seismic processing vendors.
- Geophysicists estimate that seismic data are reprocessed about 30% of the time at a later date and as new and related (i.e., well log) data become available. Stratigraphic analysis and synthetic modeling techniques are used on a remote batch and, more frequently, interactive basis to assist in improved interpretation.
 - Color graphics, both CRT and plotting, are being used with increasing frequency.
 - User friendly graphic software is the order of the day.
- The creation of maps for exploratory drilling showing geographic boundary, contour, layer boundary, and contour data, a complex and highly labor-

intensive application, is being impacted by minicomputer driven CAD systems with sophisticated interactive graphics software. With an expected 55% AAGR over the forecast period, petroleum companies' EDP expenditures for mapping applications will exceed \$1 billion in 1985.

B. PRODUCTION

- The six major applications in petroleum and natural gas production are shown in Exhibit II-2.
- Directors of production research report that over 35% of petroleum production related EDP expenditures are for black oil and enhanced recovery simulation for production evaluation, planning, and scheduling. Decontrol of petroleum prices will allow production decisions to be made on the basis of engineering economics, increasing the relative portion spent on valuation while reducing the portion spent on accounting and reporting.
- Expenditures for drilling assistance will increase as deeper wells are drilled for petroleum and natural gas. Improved technology in distributed processing for pre- and post-processors and supercomputers will improve the cost effectiveness of petroleum and natural gas structural analysis and design.
- Reservoir simulation of fields modeled in 3-D, with over 5,000 grid points using closely coupled equation solution approaches, requires the resources of supercomputers such as the Cyber 205 and Cray 1S. Major petroleum companies develop their own models but use RCS resources for about 30% of over \$80 million in 1980 EDP expenditures. Lacking qualified personnel, semi-majors and large independents use both vendor models and RCS resources well over 75% of the time.
- Enhanced recovery simulation using steam, CO₂, and heat, adding nearly an order of magnitude to the computational requirements, is increasingly em-

EXHIBIT II-2

DISTRIBUTION OF EDP EXPENDITURES FOR PETROLEUM AND NATURAL GAS PRODUCTION BY APPLICATION

APPLICATION	PORTION (percent)		
	1980	1982	1985
Reservoir Simulation	30%	27%	25%
Enhanced Recovery	5	11	15
Valuation	5	7	10
Drilling Assistance	15	14	12
Engineering Analysis And Design	20	19	18
Production Accounting And Reporting	25	22	20
Total	100%	100%	100%

ployed on smaller fields to plan recovery of up to 90% of tertiary petroleum. Reserve valuation, frequently using data base services, applies geological judgment and production engineering economies to new fields based on seismic, well log, and prior production data for purposes of lease bids, financial return on investment, and determination of tax consequences of partnership arrangements. To insure due diligence, energy companies frequently use the professional services of consulting engineers, as well as proprietary programs and programs available on RCS networks.

- The drilling assistance application is accomplished through RCS services and more frequently by on-site, minicomputer-driven turnkey systems integrated with the drilling rig. The computer program optimizes drilling costs by controlling drilling variables as a function of site geology and depth. With wells, particularly natural gas, being drilled deeper (16,000-20,000 feet) EDP expenditures for drilling assistance services will continue to rise.
- Although most engineering services for production subsector functions such as offshore platform design and construction are contracted for through related civil engineering and construction firms, petroleum and natural gas companies still do a significant amount of engineering analysis and design in-house and through vendor-supplied software packages offered in RCS vendor libraries. Ability to use graphic pre- and post-processing subsystems to model input and analyze output of remote batch processed, large engineering analysis and design packages is a strong inducement for petroleum and natural gas companies to use RCS services.

C. PROCESSING

- Processing subsector EDP applications are primarily engineering oriented. Applications include refinery modeling, process simulation, thermal analysis, and process planning and scheduling.

- Process control systems are increasingly linked to EDP systems for data gathering, and for optimization of the procuring process. Linear programming techniques are used to simulate and optimize process performance, taking into consideration such parameters and variables as demand, energy consumption, pollution, type and quality of input, and safety.
- Engineering applications are frequently designed and developed by consulting engineering companies and offered as software packages for in-house installation or through RCS companies. Some engineering companies buy block time from RCS vendors, offering software, processing, and professional consulting services to energy companies.
 - Petrochemical and Refinery Modeling System (PRMS), offered by Bonner and Moore as a software package or through their own data processing subsidiary, is an economic modeling system for planning refinery complexes.
 - PROGRESS, offered by Profimatics, is a refinery operations simulation package available for in-house installation on a lease basis or by RCS through GEISCO. Cracking and reforming process simulation systems are also available on the same basis.
 - Products and Resources Optimization Model (PROM), offered by Sun Information Services, is a computerized planning system for optimizing processes using linear program technology.
 - Thermal design offered by Gulley Computer Associates is a software package to design shell and tube heat exchangers.
 - PROCESS, offered by Simulation Sciences both as a software package for in-house installation, and through numerous RCS vendors including UCS, UCC, CDC, McAuto, CSC, and GEISCO, is a comprehensive process simulation system for designing petroleum refineries and other hydrocarbon related energy processes.

- HEX NET, offered by Profimatics as a software package and on an RCS basis through GEISCO, is used to solve complex heat exchange problems.
- ANSYS, offered by Swenson Analysis Systems, widely available on RCS vendor networks including CSC, CDC, UCC, UCS, and McAuto, is a comprehensive finite element program for static and dynamic structural analysis and petroleum refinery and other energy process designs.

D. TRANSPORTATION

- A primary application for oil and natural gas pipeline transmission companies is product accounting of the quantity of input and output of carbon products by seller and buyer. Petroleum pipelines are used between producers and refiners and crude swapping frequently occurs between majors and independents. Petroex is a pipeline exchange accounting service subscribed to by participating petroleum companies using the GEISCO network. Petrodata, offered by Scientific Software through its service bureau subsidiary, is a fully integrated petroleum accounting system for petroleum and natural gas pipeline transportation.
- Natural gas transmission companies, forced to better support gas rate price structures before state and federal public utility commissions, are increasingly using computer-aided financial management and planning systems.
- Day-to-day pipeline operations are automated by minicomputer driven process control systems for controlling pressures, temperature, and flow rate, and for data acquisition. The process control systems are being integrated with host EDP systems for data recording and for optimization of transmission flow.

- Another primary use of EDP in the transportation subsector is scientific and engineering applications. Applications include: pipeline design, flow analysis and optimization, engineering analysis, and tanker scheduling and loading.
- Engineering applications are frequently designed, developed, and offered by engineering companies as software packages for in-house installation or through RCS companies.
 - TRIFLEX, developed by AAA Technology and offered through various RCS companies including CSC, UCC, CDC, McAuto, and UCS, performs pipeline stress analysis.
 - GASUS and GASSS, developed by Stoner Associates and offered both as a software package for in-house installation and through National CSS, are used for unsteady- and steady-state flow modeling natural gas transportation systems.
 - McAuto Pipeline is used for static and dynamic piping stress analysis for petroleum, natural gas, and coal slurry pipelines.
 - ADSIP, offered by SIS, produces isometric drawings and deals with all material handling functions associated with pipeline construction.
 - Piping Analysis Systems, offered by CDC Cybernet, performs static, dynamic, and thermal analysis of three-dimensional piping systems.

E. MARKETING

- The major portion of EDP for the day-to-day marketing operations of most energy companies is done in-house. Large data centers, primarily IBM or IBM compatible, have been installed to support on-line operations using CRT terminals and DBMS. General timesharing has been largely shifted in-house.

Applications cover the full range of MIS applications including: market planning, financial accounting, credit card operations, order entry, inventory control and corporate reporting.

- Operating in both national and international financial markets, petroleum companies use cash management services including those offered by NDC, Chase Manhattan, Chemical Bank, and ADP.
- Petroleum and liquefied natural gas (LNG) companies use computer services vendors including Petrodata Corporation and Tymshare's Tele-Fuel to schedule the delivery and handle the invoicing of fuel and LNG to businesses and consumers primarily in the northeastern, eastern, and upper midwestern states. The services include delivery scheduling using degree day data bases, delivery route optimization, burner service inventory control, and all general accounting functions.
- Turnkey systems are also used by energy companies in the marketing sub-sector. Petroleum and LNG companies use Automated Bulk Terminal (ABT) systems to control and account for dispensing products to company and dealer trucks. ABTs are purchased to improve productivity and cash flow by on-site preparation of invoices and bills of lading, and for physical and product security, product allocation, and inventory management.
- Computer networks to decentralize systems, handle satellite ABTs, and collect usage and accounting data are increasing in importance. Of 2,000 bulk terminals, over 70% are owned by major (8) and semi-major (12) petroleum companies. With only one-third of bulk terminals currently automated, the ABT market, currently over \$20 million, will rise to nearly \$90 million by 1986, a 32% AAGR.

III PRODUCT OPPORTUNITIES

III PRODUCT OPPORTUNITIES

A. DATA BASE MANAGEMENT SYSTEMS (DBMS)

- Energy industries are well on the way to applying DBMS systems to create data bases and manage the day-to-day business of their operations. The need is particularly strong in the petroleum and natural gas sectors, but there is a shortage of personnel qualified in DBMS techniques with industry knowledge. Existing DBMS including data dictionaries and query systems need to be made "user friendly" to the geophysicist, geologist, and petroleum and process engineer.
- DBMS and services are needed in the exploration subsector for handling interpreted seismic, well, geographic, and surface contour data for computer-aided interpretation and mapping. Equally, DBMS and services are needed in the production subsector for lease, well log, core, seismic, well history, and production and field grid point data for black oil and enhanced recovery simulation, for valuation, and for production scheduling.

B. COMPUTER-AIDED MAPPING SYSTEMS

- Expanded exploration activity by energy industries has accelerated the demand for effective computer-aided mapping systems to direct exploratory drilling.

These systems now follow seismic exploration by months as opposed to a former one- to two-year lag.

- Computer-aided mapping systems which are either turnkey systems or nodes on a distributed network (RCS or in-house) combine CAD technology with user friendly interactive operator, distributed DBMS, advanced mapping systems, regular and high-resolution color CRTs, and improved resolution electrostatic and color plotting.

C. DATA BASE SERVICES

- There is a wealth of available (but not yet organized) data related to energy markets which would find eager use by at least exploration and production managers. Information about mineral rights and leases, state and federal related, is currently poorly catalogued and unreliable. Information about area geology, exploratory well history, past production history, and other related data is currently gathered predominantly by hand for reservoir simulation, validation, planning, and scheduling.
- Investment decisions involving high risk and large dollars imply that generic data coupled with rapid delivery and proprietary software will be high in "value added" for on-line data base services vendors.

D. ADVANCED SOFTWARE PRODUCTS

- The availability of large scientific computers using vector architecture offers new opportunities for approaching solutions to engineering problems in energy industries that, but a few years ago, were considered too large or complex for digital solution.

- New and improved mathematical approaches are needed to improve cost/effectiveness of solutions to 3-D seismic data processing. Improved computer aided approaches are needed to assist the geophysicist and directly support the ecologist in exploration decision making.
- With oil shale, coal gasification and liquefaction, and open pit coal mining projects each projected to cost in the billions of dollars, advanced engineering software is required to analyze project design planning, scheduling, production and profitability.

E. FINANCIAL MANAGEMENT AND PLANNING SYSTEMS

- Decontrol of petroleum and natural gas prices, and the projected increase in demand for coal and other energy sources, is resulting in the demand for more rational approaches to reserve valuation, production cost and pricing, and financial decision making.
- There is a need to interface on an interactive basis financial management and strategic planning models with the output of engineering simulation models such that exploration, production, and processing management can rapidly interact with corporate management in operations budgeting, capital expenditure planning, and in long-range strategic and financial planning.

F. MINE PRODUCTION AND ENVIRONMENTAL CONTROL SYSTEMS

- Use of electronic automation to improve productivity has not until recently been a high-priority item. With increasing cash flow resulting from increased price and demand, coupled with entry of petroleum companies bringing experience in process automation, coal companies are looking at micro-minicomputer driven "floor plan" production and environmental control systems to improve operational efficiency and at the same time underground mine safety.

IV COMPETITIVE ENVIRONMENT

IV COMPETITIVE ENVIRONMENT

A. VENDOR TYPES

- Petroleum companies such as Amoco and Shell offer software products, primarily industry oriented, for engineering analysis and design in three subsectors. An exception is Sun Oil, whose data processing subsidiary, Sun Information Services (SIS), is counted as an RCS vendor.
- Seismic data processing vendors such as Western Geophysical are specialist firms concentrating in exploration data processing. Some, like Geosource, offer engineering services including data processing and software packages in production applicational areas.
- Remote computing vendors offer processing services and to a degree professional consulting services across all market subsectors; e.g., the two major vendors, CDC and GEISCO. Other RCS vendors like McAuto offer services in several but not all subsectors, but most tend toward specialization in one.
- Industry consultants and specialists such as Intercomp, Scientific Software, Garret, and Earth Technology offer professional services, software products, and RCS services through buying block time from RCS vendors. They are concentrated in the exploration and production subsectors.

- Engineering and consulting firms such as Stoner Associates, Gulley Associates, Profimatics, and Fluor Mining and Metals offer professional consulting services and software products primarily through licensing arrangements with RCS vendors. Each company specializes in one or two subsectors, and together they cover all but the marketing subsector.
- Combining mini/micro and more recently mega-minicomputers with specialized software products, turnkey vendors like Digicon, ESI, Minetics, and Foxboro offer a wide variety of turnkey systems for data processing, process control, and increasingly overlapping automation functions across all energy market subsectors.

B. VENDOR MARKET SHARE

- Only the software component of turnkey vendor revenues for data as opposed to process control is considered part of computer services revenues. That component represents software licensed from other vendors, such as computer vendors or software specialists. Such revenues are included as part of the revenues of the applicable company providing the software product.
- Seismic data processing vendors have just over half the total market share, as shown in Exhibit IV-1. Providing bundled computer processing, software, and professional services by job, under FM arrangements, and through turnkey systems, new vendors are appearing almost daily in Denver and Houston.
- RCS vendors, led by CDC and GEISCO, hold nearly 20% of the current market.
- The professional services component of computer services revenues is significant due to the large number of consultants, specialists, and engineering and construction firms such as Scientific Software, Profimatics, and Chemshare.
- Computer vendors, including IBM, CDC, Univac, and DEC share (13%) in the market primarily through licensing of system software for in-house and turnkey system use.

EXHIBIT IV-1

VENDOR SHARE OF COMPUTER SERVICES IN
ENERGY MARKETS BY TYPE, 1980

COMPANY TYPE	COMPUTER SERVICES REVENUES (\$ millions)			
	PROCESSING SERVICES	SOFTWARE PRODUCTS	PROFES- SIONAL SERVICES	TOTAL
Seismic Data Processing Vendors	\$480	\$ 15	-	\$495
Remote Computing Services Vendors	155	-	\$ 28	183
Industry Consultants and Specialists	45	25	38	108
Engineering and Construction Firms	21	10	26	57
Computer Vendors	-	100	22	122
TOTAL	\$701	\$150	\$114	\$965

APPENDIX: DATABASE

EXHIBIT A-1

FORECAST OF COMPUTER SERVICES EXPENDITURES IN ENERGY MARKETS BY SUBSECTOR, 1980-1985

SUBSECTOR	USER EXPENDITURES (\$ millions)		AAGR 1980-1985 (percent)
	1980	1985	
Exploration	\$578	\$3,900	46%
Production	145	510	29
Processing	73	170	18
Transportation	79	180	18
Marketing	90	240	22
Total	\$965	\$5,000	39%

EXHIBIT A-2

FORECAST OF COMPUTER SERVICES IN ENERGY
MARKETS BY MODE OF DELIVERY, 1980-1985

COMPUTER SERVICE		USER EXPENDITURES		
MODE	TYPE	1980 (\$ millions)	1985 (\$ millions)	AAGR 1980-1985 (percent)
Remote Computing Services		\$239	\$1,658	47%
Facilities Management		135	1,300	57
Batch		327	1,144	28
Subtotal Processing Services		\$701	\$4,102	42%
Software Products	Systems	100	338	28
	Applications	50	205	33
Subtotal Software Products		\$150	\$ 543	29%
Professional Services	Services	114	355	26
	Facilities Management	-	-	-
Subtotal Professional Services		\$114	\$ 355	26%
Total		\$965	\$5,000	39%

EXHIBIT A-3

FORECAST FOR PROCESSING SERVICES IN ENERGY
MARKETS BY TYPE OF DELIVERY, 1980-1985

COMPUTER SERVICE		USER EXPENDITURES		
MODE	TYPE	1980 (\$ millions)	1985 (\$ millions)	AAGR 1980-1985 (percent)
Remote Computing Services	Function Specific	\$ 66	\$ 314	36%
	Industry Specific	57	759	68
	Utility	117	487	33
Subtotal		\$240	\$1,560	46%
Facilities Management	Function Specific	25	75	24
	Industry Specific	110	1,225	62
	Utility	-	-	-
Subtotal		\$135	\$1,300	57%
Batch	Function Specific	2	3	9
	Industry Specific	\$324	\$1,139	29%
	Utility	-	-	-
Subtotal		\$326	\$1,142	29%
Total Processing Services	Function Specific	93	392	33
	Industry Specific	491	3,123	45
	Utility	117	487	33
Total		\$701	\$4,002	42%

